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INFLATABLE DEVICE WITH RECESSED FLUID CONTROLLER AND MODIFIED ADJUSTMENT DEVICE

This application claims priority to U.S. Patent Application No. 60/204,836, filed May 17, 2000 and to U.S. Patent Application No. 60/280,040, filed March 30, 2001.

Background

1. Field of the Application

The application is related to inflatable devices, and, more specifically, to an inflatable device with a recessed fluid controller and modified adjustment device.

2. Description of the Related Art

Inflatable devices are used in a variety of contexts , such as where buoyancy or a cushioned support is needed, where space is limited or portability is desired. For example, inflatable mattresses, cushions and other body supports are used for applications such as camping, hospital bedding, and both occasional and everyday bedding in the home. Such inflatable devices have the additional advantage that the degree of inflation of the support can be adjusted to provide selective support of an irregular object, such as a person. Other examples of inflatable devices include boats, rafts and other devices for use in the water.

A variety of methods are known for providing a fluid, such as air, to inflate an inflatable device. Typically, a pump is used to supply fluid to an orifice in the inflatable device. In most instances, fluid is introduced into inflatable devices through an inlet that may be sealed to retain fluid within the inflatable device. The inlet may also serve as an outlet for deflating the inflatable device. A pump for use with an inflatable device may include a motor that drives an impeller, moving the fluid into, or out of, the inflatable device. Motorized pumps may be powered by electricity. Typically, such electricity is provided by a connection to standard house current or, where portability is desired, batteries.

One known inflatable device is illustrated in FIG. 1. This inflatable device is adapted for use as a mattress and includes a bladder 20 constructed to contain air in the shape of a mattress. The inflatable device also includes a fluid controller 80 connected to bladder 20 comprising a pump adapted to inflate bladder 20 when connected to household electric current. One such pump is described in U.S. Patent No. 5,267,363, herein incorporated by reference.

Summary

In one embodiment, the application is directed to an inflatable device comprising a substantially fluid impermeable bladder and a fluid controller comprising an electrically powered pump at least partly positioned within the bladder.

In another embodiment, the application is directed to a combination of a fluid controller comprising an electrically powered pump and an inflatable device. The combination comprises the fluid controller connected to the inflatable device such that the exterior profile of the fluid controller and inflated inflatable device in combination is essentially the same as the exterior profile of the inflated inflatable device.

In another embodiment, the application is directed to an inflatable system comprising a substantially fluid impermeable bladder and a fluid controller comprising pump in fluid communication with the bladder. The fluid controller further comprises a first locking mechanism and a adjustment device including a second locking mechanism sized and adapted to reversibly mate with the first locking mechanism.

In another embodiment, the application is directed to an inflatable device, comprising a substantially fluid impermeable bladder and a fluid controller. The fluid controller comprises an electrically powered pump, a self-sealing valve, and an adjustment device. The adjustment device comprises a first switch electrically connected to the pump and a power source such that the first switch may selectively energize the pump, and a second switch electrically connected to a power source and electro-mechanically connected to a valve of the fluid controller such that it may selectively open the valve.

Brief Description Of Drawings

The foregoing and other advantages of the application will be more fully appreciated with reference to the following drawings in which:

FIG. 1 is a top, plan view of a prior art inflatable device;

FIG. 2 is a top, plan view of an inflatable device according to one embodiment of the application;

FIG. 3 is a perspective, plan view of a fluid controller according to one embodiment of the application;

FIG. 4 is a perspective, plan view of a fluid controller according to another embodiment of the application;

FIG. 5 is a top, cross-sectional view of one embodiment of the application;

FIG. 6 is a side, cross-sectional view of another embodiment of the application;

FIG. 7 is a side, cross-sectional view of another embodiment of the application;

FIG. 8 is a perspective, plan view of another embodiment of the application; and

FIG. 9 is a perspective, plan view of another embodiment of the application.

Detailed Description

The application is directed to an inflatable device with a recessed fluid controller and modified adjustment device. As used herein, a fluid controller is a device capable of regulating fluid flow and may include various components, such as a housing, valve, fluid conduit, pump, and the like. In one embodiment, the application is directed to an inflatable device including a substantially fluid impermeable bladder and a fluid controller comprising an electrically powered pump at least partly positioned within the bladder. As used herein, an object, such as a fluid controller, that is "positioned within" a bladder occupies a portion of the volume that would normally be occupied by the bladder, but need not be within the wall of the bladder. For example, a fluid controller could be located within a recess in the wall of a bladder and be "positioned within" the bladder, as this term is defined and used herein.

Referring now to the figures, and, in particular FIG. 2, one embodiment of an inflatable device according to the application will be described by way of example. The embodiment illustrated in FIG. 2 includes an inflatable device 10 having a substantially fluid impermeable bladder 20 and a fluid controller 80 comprising an electrically powered pump at least partly positioned within bladder 20.

Bladder 20 may be constructed in any manner and of any material(s) capable of retaining a desired fluid under a degree of pressure necessary for its intended application. For example, bladder 20 may be constructed of a substantially fluid impermeable barrier and may be shaped in accordance with its intended use. Where bladder 20 is intended for use as a mattress, bladder 20 may be constructed in the shape and thickness of a conventional mattress.

Bladder 20 may include internal structure, such as ribs or partitions. For example, bladder 20 may be divided into two or more separate fluid containing compartments. Bladder 20 may also include internal structure to control the movement of fluid within bladder 20. For example, bladder 20 may include baffles or walls within bladder 20 to improve the flow of fluid when bladder 20 is inflated or deflated.

A wall of bladder 20 may be any thickness required to substantially contain a fluid under pressures at which bladder 20 will be used. A thickness of the wall of bladder 20 may

depend upon material from which bladder 20 is constructed. For example, more durable or elastic materials may not require the wall of bladder 20 to be as thick as less durable or elastic materials. Typically, the wall of bladder 20 may be 4-16 mils thick for polyvinyl chloride (PVC) film and polyurethane materials.

Bladder 20 may be constructed of any material or materials capable of substantially containing a fluid and forming a bladder 20 strong enough to withstand a pressure at which bladder 20 is to be used. For example, bladder 20 may be constructed of a polymeric material, such as a thermoplastic. Bladder 20 may be constructed from a relatively inexpensive, easy to work with and durable material. Some example materials include polyvinyl chloride (PVC) film and polyester. The manner of making bladder 20 may depend on its material of construction and configuration, as will be recognized by one of ordinary skill in the art.

Bladder 20 may include additional materials to improve the utility and comfort of bladder 20. For example, bladder 20 may include outer layers or coatings for durability, support or comfort. In some embodiments, bladder 20 may be coated with a material that is more pleasant to the touch than the material from which bladder 20 is constructed. Where inflatable device 10 is for use in supporting a person, bladder 20 may also include a layer to provide additional comfort, particularly where the person is to contact bladder 20. For example, bladder 20 may include a comfort layer. The comfort layer may be located on any surface of bladder 20 that may come into contact with a user of inflatable device 10. The comfort layer may improve the texture and feel of bladder 20 and, further, may allow air and moisture to pass between a person and bladder 20, preventing discomfort.

Fluid controller 80 may be constructed in any manner and using any materials that allow fluid controller 80 to control the flow of fluid into and/or out of bladder 20. In one embodiment, fluid controller 80 includes a pump that may be constructed in any manner and using any materials that allow it to inflate and/or deflate bladder 20. For example, as illustrated in FIG. 5, the pump may be a conventional fluid pump including a motor 84 that drives an impeller 86 moving air into, or out of, bladder 20. Where the pump includes motor 84, motor 84 may be powered by electricity. Electricity may be provided by a connection to standard house current or, where portability is desired, by batteries. Other types of pumps, such as diaphragm pumps, may also be used so long as they allow the pump to inflate bladder 20 to within a desired pressure range, which may include a pressure range that can be adjusted by, for example, another fluid pumping device, such as someone blowing into a conventional valve stem within the bladder, a foot pump, and the like.

Fluid controller 80 may direct fluid flow in any manner consistent with its construction. For example, where fluid controller 80 includes a pump with motor 84 and impeller 86, impeller 86 may draw fluid into, or out of, bladder 20 through a conduit 88. In some embodiments, conduit 88 may be positioned between motor 84 and a housing 90, as an annulus. For example, in the embodiment illustrated in FIG. 5, fluid controller 80 includes a housing 90 that surrounds the inner workings of the pump. Housing 90 may also serve, for example, to protect the inner workings of the pump and to provide a connection between fluid controller 80 and bladder 20.

Preferably, where a pump is included in fluid controller 80, the pump is able to inflate bladder 20 in a relatively short time period, such as in less than a minute for an inflatable mattress. The pump may be designed to include an appropriately powerful fluid moving mechanism to achieve a desired pumping time to fill a particular inflatable device. The pump also may be small and consume as little power as possible. Low power consumption is particularly desirable where the pump is to be powered by batteries, as it may extend battery life. The pump may also be configured to be quiet in operation. A balance of pumping capacity, size, power consumption, noise generation and cost may be selected for a particular application as will be recognized by those of skill in the art.

Fluid controller 80 may be constructed of any material or materials that allow it to function as desired. Typical materials of construction of the various components of fluid controller 80 will vary with the nature of fluid controller 80 and any pump and are known to those of skill in the art.

Fluid controller 80 may be connected to bladder 20 in any manner that allows a pump to supply bladder 20 with fluid, inhibits undesired escape of fluid from bladder 20 and does not interfere with the use of bladder 20. For example, inflatable device 10 may be constructed with at least a portion of fluid controller 80 positioned within bladder 20. Where fluid controller 80 is positioned at least partially within bladder 20, fluid controller 80 will not interfere with the use of inflatable device 10. In one embodiment, the exterior profile (total volume and shape) of the fluid controller and inflated device in combination are essentially the same as the exterior profile of the inflated device absent the combination, thus reducing the opportunity for fluid controller 80 to impact or interfere with the use of inflatable device 10. For example, where fluid controller 80 is located substantially within bladder 20 in a mattress application, it allows an inflatable standard sized mattress to fit into a standard sized bed frame. Where fluid controller 80 is located within bladder 20, it may

be sized such that it will not come into contact with bladder 20 when bladder 20 is inflated, except at the point(s) of connection.

Where at least a portion of fluid controller 80 is positioned within bladder 20, it may be connected to bladder 20 in any manner that will not interfere with the use of inflatable device 10 or allow undesired escape of fluid from bladder 20. For example, bladder 20 may be adhered or sealed to a portion of fluid controller 80, such as with an adhesive or heat seal. In one embodiment, an outlet 120 (illustrated in FIG. 8) of fluid controller 80 is sealed to bladder 20.

Fluid controller 80 may include structure to facilitate connection to bladder 20. For example, fluid controller 80 may include a portion adapted to connect to bladder 20, such as a flange 82 as illustrated in FIGS. 3-5. Flange 82 may, for example, extend from housing 90 or may be a separate component connected to housing 90. As best seen in FIG. 5, flange 82 may include additional structure, such as a fluid impermeable wall 83, that may allow it to perform other functions in fluid controller 100 in addition to providing a connection point for bladder 20. Where flange 82 is connected to housing 90, it may be connected anywhere and in any manner that allows it to fluid tightly connect fluid controller 80 and bladder 20. For example, where flange 82 includes a fluid impermeable wall 83, flange 82 may be connected to housing 90 at or near outlet 120 from housing 90.

Flange 82 may be constructed of any material that allows it to durably and fluid tightly connect fluid controller 80 to bladder 20. For example, flange 82 may be constructed o a material that is more flexible than housing 90, but less flexible than bladder 20, bridging the flexibility gap between the two structures and resulting in a durable seal that may be performed, for example, by heat sealing. One example suitable material of construction of flange 82 is PVC. The thickness of flange 82 may also affect its flexibility, with thinner flanges generally being more flexible than thicker flanges. Thus the thickness of flange 82 may be selected to provide a desired flexibility with a given material.

Where flange 82 connects to housing 90 or another portion of fluid controller 80, it is preferred that such connection be reversible. For example flange 82 may snap or screw together with another portion of fluid controller 80. Additional structure may be included to promote a fluid seal between flange 82 and the remainder of fluid controller 80. For example, a seal, such as an o-ring, may be placed between flange 82 and the remainder of fluid controller 80. It is also possible to construct the inflatable device such that bladder 20 and fluid controller 80 are reversibly connected, rather than two portions of fluid controller 80 being reversibly connected. In either case, the reversible connection allows the removal

of portions of fluid controller 80 for repair or replacement, preventing the entire inflatable device from having to be disposed of in the event of a failure of one component.

Bladder 20 may also include structure to facilitate the connection between bladder 20 and fluid controller 80. For example, bladder 20 may have a portion constructed to facilitate connection of fluid controller 80 to bladder 20, such as a retainer 22 as illustrated in FIGS. 7 and 13. Retainer 22 may be construction in any manner that will facilitate connection between bladder 20 and fluid controller 80, such as by mechanically supporting fluid controller 80. For example, retainer 22 may be constructed as a strap positioned across fluid controller 80.

It will now be clear that fluid controller 80 may be positioned within bladder 20 in a variety of ways. For example, fluid controller 80 may include a flange 82 that positions it at least partially within bladder 20. The size and shape of flange 82 may be selected to control the portion of pump 80 that is positioned within bladder 20. Alternatively, bladder 20 may include a recess and fluid controller 80 may be positioned within the recess and attached to bladder only at a pump outlet, or at other locations within the recess.

Fluid controller 80 may be operated by any conventional control mechanism, such a conventional power switch. Fluid controller 80 may also include a structure for controlling fluid controller 80, such a adjustment device 100. Adjustment device 100 may be separate or separable from fluid controller 80 to allow fluid controller 80 to be controlled remotely. In one embodiment, adjustment device 100 is a hand-held device for controlling fluid controller 80.

Adjustment device 100 may include structure for controlling the operation of fluid controller 80. For example, adjustment device 100 may include a conventional power switch 102 that energizes and de-energizes a pump within fluid controller 80. Switch 102 may be any of the many well-known mechanisms for selectively connecting two conductors to supply electricity to a point of use. Switch 102 may allow the pump to be energized such that it inflates bladder 20. Adjustment device 100 may also include structure that directs the deflation of bladder 20. For example, a second switch may reverse the direction of the pump to deflate bladder 20. In some embodiments, fluid controller 80 may incorporate a valve which must be opened to allow deflation of bladder 20. In these embodiments, adjustment device 100 may also include structure to mechanically or electro-mechanically open a valve to allow deflation of bladder 20. For example, a switch 106 may act upon a mechanical opening mechanism or activate a solenoid 104 to open a valve, such as valve 122, and allow deflation of bladder 20. In one embodiment, the valve that is opened is a

self-sealing valve, meaning that it is held closed, at least in part, by pressure within bladder 20. For example, a self sealing valve may include a diaphragm 124 that is urged against a valve seat 126 by fluid pressure from within bladder 20. Optionally, switch 106 may also energize the pump to withdraw fluid from bladder 20.

In one embodiment, adjustment device 100 is connectable to fluid controller 80. In this embodiment, adjustment device 100 may be connected to fluid controller 80 at a conveniently located position such that it is easily found, particularly when inflatable device 10 is in use. For example, where inflatable device 10 is a bed, fluid controller 80 may be located at the head of the bed such that adjustment device 100 may be connected thereto for easy access when the bed is in use. Any control elements on adjustment device 100, such as switches 102, 106 or a button 108 may be located on adjustment device 100 for easy access. For example, the control elements may be located on a top portion of adjustment device 100, as illustrated in FIG. 4. Attachment of adjustment device 100 to fluid controller 80 may also facilitate deflation of bladder 20 with adjustment device 100. For example, where a valve must be opened to deflate bladder 20, adjustment device 100 may be in mechanical communication with fluid controller 80 to disengage the valve. In one embodiment, a button 108 on adjustment device 100 may be in mechanical communication with fluid controller 80 to open a valve.

The connection between adjustment device 100 and fluid controller 80 may be secure. For example, in one embodiment, adjustment device 100 reversibly locks to fluid controller 80. Where adjustment device 100 locks to fluid controller 80, adjustment device 100 and fluid controller 80 may include mating locking mechanisms 110, 112. Locking mechanisms 110 and 112 may be constructed in any manner and using any material(s) that allow locking mechanisms 110, 112 to reversibly lock together. By "lock" it is meant that two mechanisms fit together in such a way that a force must be overcome to separate them. In one embodiment, one locking mechanism 110 includes one or more spring latches 114 that mate with impressions 116 in other locking mechanism 112. Either locking mechanism 110, 112 may be located on either of adjustment device 100 or fluid controller 80.

Having thus described certain embodiments of the inflatable device of the application, various alterations, modifications and improvements will be apparent to those of ordinary skill in the art. Such alterations, variations and improvements are intended to be within the spirit and scope of the application. Accordingly, the foregoing description is by way of example and is not intended to be limiting. The application is limited only as defined in the following claims and the equivalents thereto.

What is claimed is: